IR and Beam-beam deliverables for FY05 and FY06

T. Sen

IR design

FY05: IR deliverables

We will examine basic versions of the quadrupole first and dipole first layouts for the IR upgrade. The aim will be to develop self-consistent matched designs that meet the known constraints, e.g. from injection optics. We will not attempt to develop fully optimized designs. The designs will be used for a first evaluation of:

- Requirements on field quality in the IR magnets
- Limits on β^* from optics
- Energy deposition and radiation environment in the interaction region in both designs. Also further development of energy deposition calculations with heavy-ion operations.

FY06: IR deliverables

We envision working closely with the magnet designers on the impact of field quality requirements and energy deposition calculations developed in FY05 for both quadrupole and dipole first designs. We will iterate on the designs as part of this collaborative effort. Other aspects of the design studies will include:

- Development of nonlinear correction schemes for both designs
- Designs with large crossing angles if superbunches are under consideration for the LHC upgrade
- Energy deposition and design of magnet protection systems with the different IR optics designs.
- Studies of near-beam experiments and their interference with the IR systems: TOTEM and Zero-degree calorimeters.

Topic	Institution	FY05 FTE	FY06 FTE	Participants
IR optics design	FNAL	0.5	0.5	T. Sen, M. Syphers, Post-doc 1
”	BNL	0.2	0.3	S. Tepikian
Energy Deposition	FNAL	0.4	0.4	N. Mokhov, Post-doc 2

Beam-beam calculations

The beam-beam effort splits naturally into two distinct groups: (1) IR design related (mostly at FNAL), (2) Strong-strong simulations (at LBNL)

FY05: IR design related beam-beam deliverables

We will examine the impact of beam-beam interactions on the IR designs. The aims will be to (a) determine if these constraints strongly favor one design and (b) determine limits on optics parameters such as the crossing angle from β^*, bunch intensities, number of bunches etc. These limits will be used as inputs to the IR designs. Other activities will include:

- Participation in the machine study of wire-based compensation at the SPS and subsequent analysis of the data
- Theoretical evaluation of wire compensation with the quadrupole design

FY05: Strong-strong simulation deliverables

- Use the strong-strong code BEAMBEAM3D to simulate LBNL's "sweeping-beam" LHC luminometer. The aim will be to establish the optimum signal to noise ratio (or efficiency vs. integration time).
- Simulate long-time emittance growth for strong-strong collisions. As byproducts, determine the following: (a) Disentangle numerical from physical emittance growth, (b) Quantify halo formation due to beam-beam, (c) Working point dependence of emittance growth.

FY06: IR design related beam-beam deliverables

- Detailed simulations of wire-based compensation with realistic values of magnet parameters in the quadrupole first design
- Beam-beam constraints on alternative IR designs, including those with superbunches.

FY06: Strong-strong simulation deliverables

- Extended long-time emittance growth including effects from crossing angles, parasitic collisions, bunch length, intensity and closed-orbit variation bunch by bunch
- Benchmark BEAMBEAM3D against CERN's fast-multipole code
- Effect of parasitic collisions on long-time emittance growth and halos

Topic	Institution	FY05 FTE	FY06 FTE	Participants
IR design related	FNAL	0.3	0.3	T. Sen, Post-doc 1
Strong-strong simulations	LBNL	0.2	0.3	J. Qiang